Mechanisms of Polycyclic Aromatic Hydrocarbon Toxicity in Early Life History Stages of Fish

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Abstract

Urbanization contributes fossil fuel-derived polyaromatic hydrocarbons (PAHs) to aquatic and estuarine environments. In the Georgia Basin/Puget Sound region, non-point sources of PAHs are increasing. Regional monitoring studies have detected PAHs in both marine and anadromous fish species, and a common suite of morphologic defects, including edema and dorsal curvature of the body axis, have been observed in marine and freshwater fish embryos exposed to hydrocarbons in the laboratory and in the field. However, basic mechanisms of PAH toxicity in fish embryos and larvae are still poorly understood. To address this uncertainty, we designed a study to (1) identify the tissue and molecular targets of PAHs during early developmental stages, and (2) determine which individual PAH congeners (within a complex mixture) contribute to the morphological defects that have been previously reported. These studies were conducted using the zebrafish *(Danio rerio)*, a leading experimental system for molecular and genetic analysis of vertebrate development. Our results indicate that:

(1) PAHs act on specific targets in the excitatory conduction system of the developing heart.

(2) Most of the morphological defects induced by PAHs are secondary to cardiac dysfunction.

(3) Dibenzothiophenes and phenanthrenes are major contributors to PAH-induced developmental toxicity.